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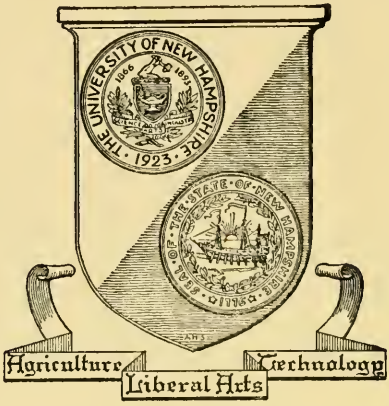

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Marketing New Hampshire McINTOSH APPLES

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AGRICULTURAL EXPERIMENT STATION
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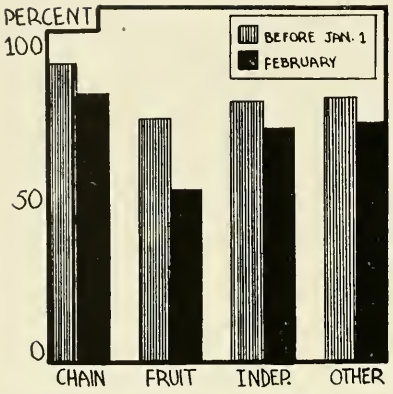

FIG. 1. PERCENTAGE OF EACH TYPE OF STORE HANDLING MCINTOSH APPLES DURING NOVEMBER 15 TO DECEMBER 31, 1940 AND DURING FEBRUARY, 1941

large number of retail stores had McIntosh apples as late as March and early April, especially where good local service was rendered direct from cold storage. Data presented in Fig. 1 show that in both periods more chain stores handled McIntosh apples than did independent stores, but many chains also handled other varieties, including western Delicious and Winesaps. (See Appendix, Table I, for complete data.)

By questioning managers of some 300 stores through the 1940-41 season it was found that about half of the retail stores were buying their McIntosh apples in their own counties, while over one-third were buying them outside the state. Stores in the northern counties must, of course, obtain part of their apples either from out of the state or from southern and central New Hampshire, but stores in the central and southern counties can buy locally in most cases if they choose to do so. However, some of our large commercial growers make no particular effort to supply local stores (Table II, Appendix). Chain stores were buying a much larger percentage outside the state (through their warehouses in such cities as Portland and Boston) than were independents. Almost twice as many stores bought McIntosh apples from local sources before January 1 as bought them locally later in the season. (See Fig. 3.) Growers could obtain more of this local business after the first of the year if they would give service direct from their cold storages to their own communities. Many independent stores bought apples from local farmers until they could no longer obtain a satisfactory supply, at which time they bought from the wholesalers who supplied them with apples shipped in either from out of the state or from nearby farmers. Fruit stores handled a good many local apples early in the season. Many also handled apples delivered by fruit wholesalers obtained from both western and nearby sources. Chain stores varied greatly in their practices. One large

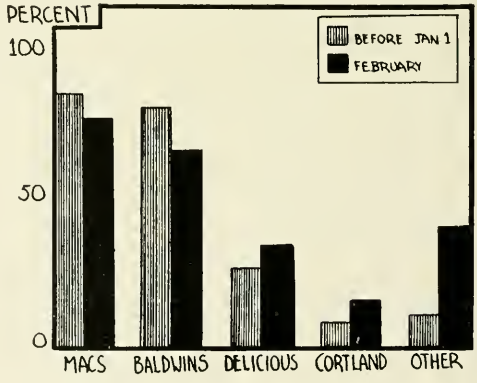

FIG. 2. PERCENTAGES OF STORES HANDLING DIFFERENT VARIETIES OF APPLES DURING NOVEMBER 15 TO DECEMBER 31, 1940 AND DURING FEBRUARY, 1941

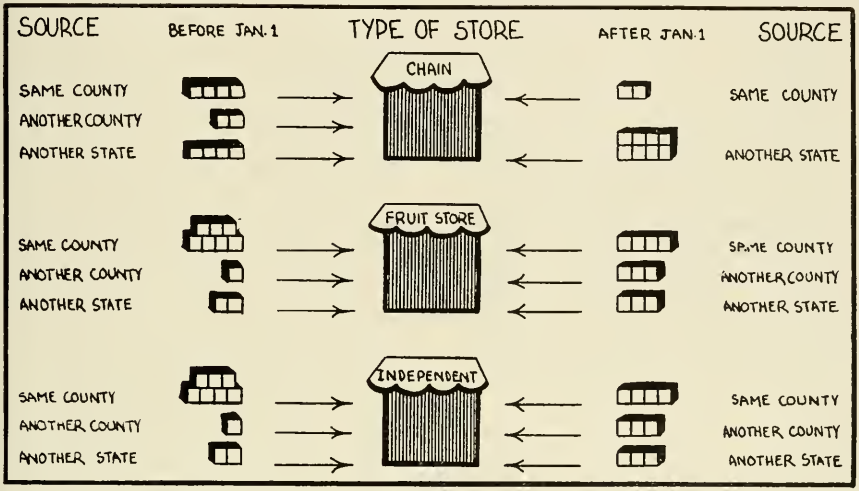

FIG. 3. SOURCES OF APPLES PURCHASED EARLY AND LATE IN THE SEASON BY THREE TYPES OF STORES. (EACH BOX REPRESENTS 10 PER CENT OF THE APPLES PURCHASED.)

chain received deliveries largely from Boston and Ayer, Mass., but part of these apples were grown in New Hampshire. Another chain made a policy of buying from local producers so long as they gave good service from their own cold storages. Agricultural Service, Inc., supplied apples from storage in Concord to a number of chains, and some apples were furnished by a Maine co-operative.

MARKET CONDITION OF McINTOSH APPLES

The deterioration of apples from producer to consumer is great. Defects are generally increased two- and threefold through handling, with a corresponding increase in waste. This would seem to justify the growers' claims that consumers are getting a far poorer product than the growers are producing. Table 2 shows a comparison of the quality of fruit at growers' storages with fruit in the market coming from these same growers.

In Various Types of Stores

There was a striking difference in the condition of apples sold in different stores. The fruit from one chain of stores had 57 per cent

TABLE 1. SOURCES OF McINTOSH APPLES FOR SIX NEW HAMPSHIRE CITIES, 1940-41

City	No. records	Percentage coming from		
		Same county	Another county	Another state
Claremont	28	0	4	96
Concord	32	88	9	3
Keene	35	6	57	37
Laconia	29	58	14	28
Manchester	57	40	37	23
Nashua	29	87	3	10

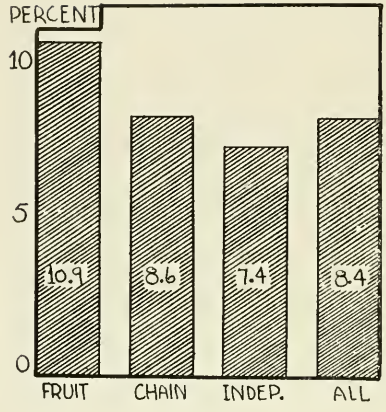

FIG. 4. PER CENT WASTE SHOWN IN APPLE SAMPLES PURCHASED IN VARIOUS TYPES OF STORES

more waste than that from another. Independent markets varied all the way from one which handled fruit with very little waste to one where the amount of waste was one-third of the total volume of the fruit. It is very evident, therefore, that there must be a difference in handling methods between various grocers, and probably a similar difference in their ideas as to what constitutes fruit worthy of sale. In general, apples sold by independent groceries and markets showed less injury and a smaller percentage of waste on the average than did those sold by chain stores, but the average percentage of waste in fruit stores was the highest in the list (Fig. 4).

In Stores of Different Cities

Considerable variation existed in the condition of McIntosh sampled in different cities. The average per cent of waste found in samples from eight cities ranged from 4 to 17 per cent, and the per cent of bruised surface from 6 to 13 per cent. Defects per 100 fruits ranged as follows: punctures 52-130; small bruises 372-804; and large bruises 102-203. This indicates that consumers are able to buy much better apples in some cities than in others.

As Influenced by Distance Hauled

In order to determine the extent of variation in condition of apples from nearby sources and those from more distant points, samples were grouped according to the distance they were hauled to market (Table 3). Although one might assume that fruit brought in locally would be in better condition, it was evident that fruit hauled the lesser distance, while being somewhat less bruised, showed a greater amount of waste. This seemed to indicate that lower grade fruit and fruit in poorer condition was sold nearby, while higher quality fruit was delivered to more distant markets.

A comparison of the condition of fruit from common and cold storage is shown in Table 4. The fruit from common storage was in

TABLE 2. GROWERS' APPLES COMPARED TO APPLES PURCHASED BY CONSUMERS

	Number of samples	Per 100 fruits			Per cent surface bruised	Per cent waste
		Cuts and punctures	Small bruises	Large bruises		
From storages - 10 good commercial growers	13	31.5	240.0	33.8	2.98	2.26
The same growers' apples from stores	45	81.1	465.5	126.1	7.56	6.88
Per cent increase from handling		157.0	94.0	273.0	154.00	204.00

TABLE 3. CONDITION OF McINTOSH APPLES IN STORES AFTER HAULS OF VARIOUS LENGTHS

Source	Number samples	Punctures per 100 fruits	Small bruises per 100 fruits	Large bruises per 100 fruits	Per cent surface bruised	Per cent waste
New Hampshire						
Hauled less than 15 miles	77	79	483	138	8.7	8.8
Hauled over 15 miles	46	66	462	142	9.	6.1
Collected at grower storages	17	43	305	88	6.5	5.2
Out of State						
Distance over 15 miles	10	75	566	220	14.1	7

poorer condition than that taken from cold storage. This may be accounted for by the fact that the man having a cold storage or storing his own fruit in cold storage gives it better care than fruit stored in common storage receives. But both the quality of the fruits going into the storages and the conditions under which they are kept are factors here.

About 42 per cent of the McIntosh apples sold came from cold storage in November, 51 per cent in December, and the bulk of those sold came from cold storage from January on. The fruit received from storage improved steadily in quality, in so far as mechanical damage was concerned, from November until the end of the storage season. Probably the grower first disposed of the fruit that was in poorest shape, since such fruit is not worth giving space and care during the winter months. Later on the well-handled fruit was brought out and sold. (Detailed figures in Tables III and IV, Appendix.)

Apparently there was also a gradual decrease in the amount of mechanical damage on fruit received by the consumer from November to March, although there was a very slight increase in March. The best fruit is placed in cold storage by growers, and much of it will come out in good condition when properly handled. But these late-stored McIntosh apples deteriorate faster under the handling in retail stores. (See Fig. 5.)

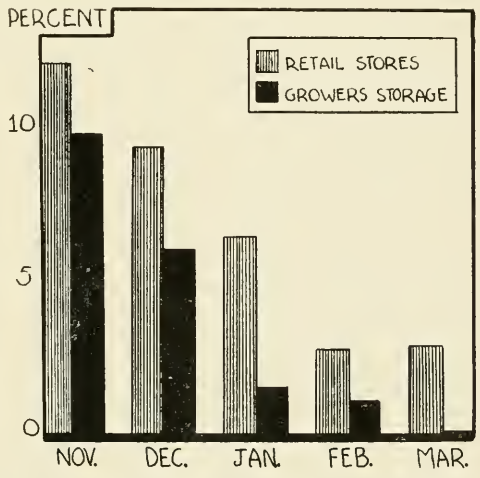

FIG. 5. WASTE FOUND IN SAMPLES OF McINTOSH APPLES PURCHASED IN DIFFERENT MONTHS

Table 4. Condition of McIntosh from Different Kinds of Storages

Source of apples	Number samples	Punctures per 100 fruits	Small bruises per 100 fruits	Large bruises per 100 fruits	Per cent surface bruised	Per cent waste
Common storage	62	84	524	143	9.8	8.6
Cold storage	91	65	428	139	8.4	6.7

TURNOVER OF APPLES IN STORES

On the average fruit stores had a slower turnover of apples than did grocery stores or super-markets. About 62 per cent of the stores had held apples three days or less. Only about 11 per cent had held apples more than a week. (See Appendix Table VI.)

Samples of apples which had been in the store for different lengths of time were secured from a super-market. New fruit had a smaller percentage of waste than that which had been kept in the store. However, after the first and up to the fifth day the condition did not change materially. This meant, very probably, that some of the worst fruit had been removed from the display to maintain the quality of the product at about the level which the storekeeper thought satisfactory. However, as the season advances, McIntosh apples deteriorate more rapidly; this is particularly noticeable if the apples have been handled to any extent. McIntosh which had been in bulk displays through the week often showed much deterioration and were difficult to sell at any price. (See Appendix Table VII.)

Similar data were obtained for a fruit store in which the manager showed much interest in maintaining the quality of his fruit. His fruit had a smaller per cent of waste than that received by the super-market, and even though it was kept in the store for seven days, it did not show a great deal of deterioration. The condition of the fruit on arrival and the interest of the manager in handling it carefully is more important than the time which the fruit stays in the store, particularly if this is a week or less and temperatures are not excessive. (See Appendix Table VII.)

FACTORS INFLUENCING RETAIL SALES OF McINTOSH

The following table gives the average weekly sales of apples as reported by retail stores.

Day of Week

In the two stores where test sales were carried on, over half the week's sales of McIntosh apples were made on Friday and Saturday. (See Fig. 6 and Appendix Table V.) If fresh displays were placed on Thursday night or early Friday morning and then reduced as much as possible on Saturday night, the apples would reach consumers in better condition, and loss from spoilage would be smaller. Any McIntosh apples placed in displays on Monday morning are likely to be in poor shape if carried over the following week-end, particularly in

the latter part of the season. Customers coming in during the first four days of the week seem to be more discriminating than those buying on week-ends. Sales from smaller displays or from the original boxes might well be made during the first four days of the week.

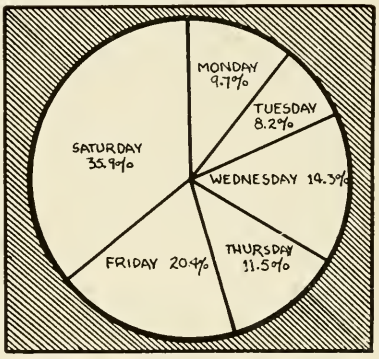

FIG. 6. WEEKLY SALE OF McINTOSH APPLES IN TWO REPRESENTATIVE NEW HAMPSHIRE CHAIN MARKETS

Time of Day

In a Nashua store, figures were kept on morning and afternoon sales of McIntosh apples for a period of two weeks. Morning sales amounted to about 22 per cent and afternoon sales (including two evenings) to 78 per cent of the total. The rate of sale in the afternoon was a little over twice the rate of sale in the morning.

Although much valuable information had been gathered through observation and collection of samples, it was believed that additional information could be obtained regarding factors influencing sales of McIntosh apples by actually selling different lots of apples side by side in retail stores. Arrangements were made to carry out test sales for periods of two weeks in a Nashua super-market during December, 1941 and in a similar market in Dover in the following February.[1]

TABLE 5. ESTIMATES OF WEEKLY SALES OF APPLES BY TYPE OF STORE (BASED ON STATEMENTS FROM 110 STORES)

Type of store	Average weekly sales* McIntosh		Average weekly sales* all apples	
	Dec. (1940)	Feb. (1941)	Dec. (1940)	Feb. (1941)
	(Boxes)		(Boxes)	
Chains (self-service)	21	15	35	36
Other chains	5	4	9.5	7
Specialty fruit markets	16	12	23	30
Fruit & misc. stores	4	3	6	6
Groceries with meat markets	5	4	8	7
Small grocery stores	2	1.5	4	1.5

*Nearest whole number.

The apples handled in the Nashua store included two lots of Fancy 3 inch McIntosh which varied mainly in the amount of bruising; two lots of 2½ inch minimum size McIntosh—one of which was Fancy grade and the other U. S. No. 1 (including occasional boxes of Fancy which showed only slightly more color); and Fancy 2½ inch minimum size Cortlands. (See Appendix Table VIII.) In the Dover store more grades and sizes were handled. The prin-

[1] Acknowledgment is made of the fine co-operation of chain store officials and managers of the A&P and First National super-markets in Dover and Nashua, where experimental sales were carried on; also for data supplied by many growers and retailers throughout the state.

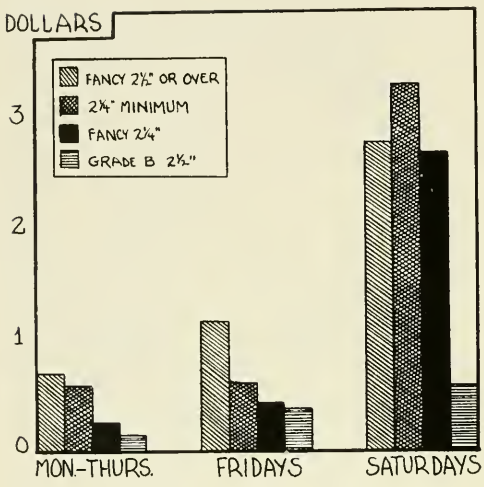

FIG. 7. AVERAGE GROSS PROFIT PER DISPLAY PER DAY FOR SEVERAL GRADES OF MCINTOSH APPLES IN A DOVER STORE. (THE SECOND ITEM, 2¼ INCH MINIMUM, WAS AN ORCHARD RUN WITH CULLS, SIZES UNDER 2¼ INCH AND BEST 3 INCH EXCLUDED.)

cipal ones were N. H. Fancy in 3 inch sizes, 2½ inch sizes, 2¼ inch sizes, Grade B, and an orchard run with the best colored 3 inch, sizes under 2¼ inch, and culls excluded. The apples were in much better condition than those handled in the Nashua store.

Influence of Grade

In the Dover store the demand for the Fancy grade exceeded all others, about 68 per cent of the total sales being of that grade. The rest of the sales were of a lower grade; an orchard run, excluding culls, sizes under 2¼ inch, and the best of the 3 inch size. They were in good condition and were delivered out of farm cold storage two or three times a week. But even though the Fancy 2½ inch (and up) sizes cost from 50 to 65 cents a box more, more than three times as many were sold in the same period of time.

When Grade B (2½ inch up) McIntosh were sold alongside Fancy 2¼ inch apples at the same price, the latter sold about twice as rapidly as the former. Since they were purchased at the same price, the store's gross profit on the small size Fancy apples was about twice as large as for the larger Grade B apples. The Grade B apples were usually purchased for cooking purposes. A mixed size McIntosh with more color was also available at the same price. Even those who wanted McIntosh for cooking preferred the lots with more color. In general, profits were considerably larger from the sale of 2½ inch and 3 inch Fancy McIntosh. It was definitely desirable to carry this grade along with a cheaper grade. The retailer wishes to carry kinds and grades of apples which please his customers and for which there is sufficient demand to return a fair profit. It is not supposed that every retailer will wish to carry all the different lots of apples mentioned in Fig. 7, but usually he can afford to carry at least two or three of them. This figure indicates the relative profitableness of the different lots offered. (See also Table IX in Appendix.) The Saturday trade was more price-minded and a moderate-priced apple in good condition and suitable for cooking was in greatest demand, but on all other days a better grade apple returned greater profits to retailers.

Influence of Size

Lots of 3 inch, 2½ inch, and 2¼ inch Fancy McIntosh were placed in adjoining lots in a Dover store. Prices on the wholesale

market for these three sizes were $2.25, $2.10 and $1.50. Although the retail price of the 3 inch size was 20 cents a box higher than that of the 2½ inch, it sold 28 per cent faster. Again, when the 3 inch size was priced 70 cents a box higher than the 2¼ inch, it sold five times as fast as the smaller size. The 3 inch apples cost more per box but they sold faster and yielded a much larger total profit than the two smaller sizes in the same period of time. (See Fig. 8 and Appendix Table X.)

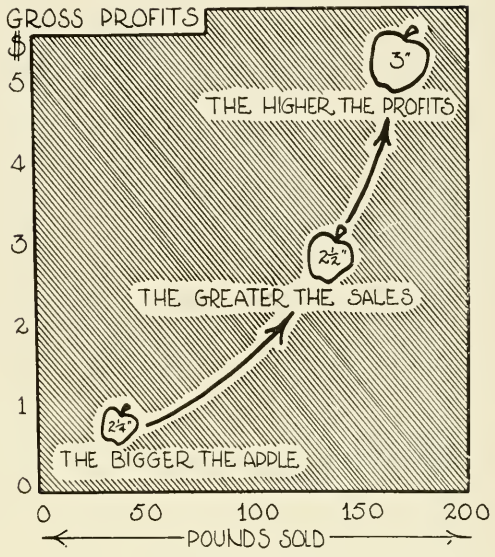

FIG. 8. RETAIL SALES AND GROSS PROFITS ON 3 INCH, 2½ INCH, AND 2¼ INCH FANCY McINTOSH APPLES SOLD IN ADJOINING LOTS OVER THE SAME PERIOD OF TIME

Influence of Condition

The larger sizes of McIntosh apples on sale in our markets are often conspicuously bruised. These large sizes should be given special care in picking, packing, trucking, and handling in stores.

Two lots of large size McIntosh (3 inch minimum) were purchased for experimental sales in the Nashua store. Lot 1 was orchard packed but Lot 2 was rehandled and packed in a city storage. Conspicuous bruising was shown in one-third of the apples in Lot 1 and in two-thirds of the apples in Lot 2. Lot 1 cost $2.25 a box as compared to $2.05 for Lot 2, but the higher priced apples definitely proved to be the better sellers. They had a more rapid turnover and netted 22 cents a box more.

To further determine reaction to bruising, two selected lots were made up from those same apples (Lots 1 and 2): Lot A - not conspicuously bruised, and Lot B - conspicuously bruised. Boxes of Lot 1 and Lot 2 together gave equal amounts of Lots A and B. The better apples in Lot A (not conspicuously bruised) sold about three and one-half times as fast at one cent more per pound than Lot B (conspicuously bruised). Even though Lot A was by no means free from bruises, it was more profitable to handle. Assuming costs of $2.45 a box for Lot A, and $1.85 for Lot B, gross profits during the sales period were 2.3 times larger for Lot A. (See Fig. 9.)

It is obvious that for such difference in profit, any reasonable means of reducing bruising would be amply repaid. Some form of protection such as a cardboard flat or heavy paper placed between layers should reduce bruising. If this were done, and the apples were packed face up, fewer stem punctures would occur than when they are packed cheek up with no separation of apples within each layer.

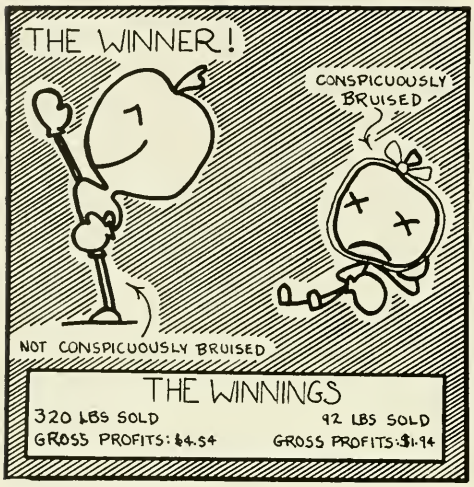

FIG. 9. COMPARATIVE GROSS PROFITS FOR THE SAME SALES PERIOD FROM SALE OF CONSPICUOUSLY BRUISED McINTOSH APPLES AND THOSE NOT CONSPICUOUSLY BRUISED

Influence of Eye Appeal

Two displays of Fancy 2½-inch McIntosh apples were placed side by side in the Dover store, one with red cheeks out and the other as they came from the box. Although faced McIntosh were priced one-half cent a pound higher than the others, the sales of these faced apples were almost four times as great as the unfaced ones, and there was every indication that the faced apples would have sold as fast as the unfaced ones if they had been priced at ¾ cent to 1 cent a pound more (Table 6). The additional time used to improve eye appeal seemed warranted, since the extra price received would certainly have covered any additional costs of handling and left a good margin of profit. (See Fig. 10.) Furthermore, there would be an additional advantage in giving the apples this extra care since there would be less bruising than if the boxes were simply dumped on the display stand.

Polished apples sold one-third faster at ½ cent per pound more than unpolished ones taken from the same box as shown in one test sale. However, some customers did not like polished apples. Further tests involving more markets and more grades of apples are needed before conclusions are drawn as to the profitableness of polishing. In these tests, faced apples sold very much better than either polished or unpolished apples which were not faced. Because polishing apples also cleans them, polished apples are more attractive in appearance.

STORE PRICES AND PROFIT MARGINS

Some store managers believe there is a fairly definite point where sales resistance is met when prices are raised, and that a sales unit

TABLE 6. RELATIVE SALES AND RETURNS FROM POLISHING AND FACING APPLES IN DISPLAY

Lots sold	Pounds sold	Per cent sales	Ave. selling price	Gross margin, per cent	Gross profit	
					Total	Per day
A. Faced	328	58	4 pounds/29 cents	29.4	$ 7.01	$1.40
B. Polished	135	24	4 pounds/29 cents	29.4	2.89	.58
C. Regular	103	18	4 pounds/27 cents	24.4	1.70	.34
3 lots	566	100			$11.60	$2.32

priced above 30 cents is not popular with consumers, but price increases do not always reduce sales if the product is really good and if the figure reached does not appear unreasonable. Many shoppers assume that the higher priced apples are better, and some of them will buy the article of highest price because they insist on having the best. When prices on three-inch fancy McIntosh were increased from 4 lbs. for 29 cents to 4 lbs. for 31 cents demand kept up surprisingly well. Even when prices were increased from 4 lbs. for 31 cents to 4 lbs. for 33 cents the percentage of three-inch apples sold actually increased (Table 7).

TABLE 7. SALES BEFORE AND AFTER PRICE CHANGES

	Price	Tuesday sales	Price change	Three following days
3 inch McIntosh	4 lbs. @ 31 cents	45 per cent	4 lbs. @ 33 cents	58 per cent
2½ inch McIntosh	4 lbs. @ 29 cents	55 per cent	(no change)	42 per cent

In another case where the price of one lot of Fancies was increased from 4 lbs. for 29 cents to 4 lbs. for 31 cents the actual percentage of sales of that lot increased from 77 per cent to 85 per cent of the total of the two lots involved.

It is not inferred here that these are normal situations, but the cases cited indicate that we must be careful in making assumptions about the price reactions of customers unless we make observations under actual market conditions.

Average Retail Prices

Figures based on 285 records taken in November, December, and February indicate that, of the various types of stores, self-service

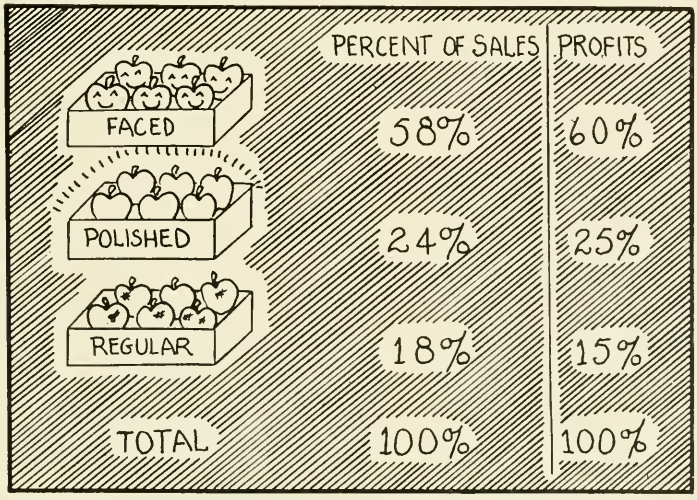

FIG. 10. RELATIVE SALES AND RETURNS FROM FACING AND POLISHING APPLES. (PERCENTAGES IN EACH CASE REFER TO PER CENT OF ALL SALES AND ALL PROFITS FOR THE THREE LOTS.)

chains and super-markets sold McIntosh at prices averaging lower than other types of stores. (See Table 8.)

Table 8. Prices at Which McIntosh Apples were Sold in Different Types of Stores, 1940-41

Kind of store	Average selling price per pound in cents			Kind of store	Average selling price per pound in cents		
	Nov.	Dec.	Feb.		Nov.	Dec.	Feb.
Chain (self service)	3.9	5.3	4.6	Fruit markets	3.9	5.2	5.8
Other chain	4.2	5.3	5.1	Ind. groc. & mkts.	4.7	5.3	5.6
Fruit & misc.	4.8	4.9	5.5	All stores	4.3	5.2	5.3

Gross retail margins on McIntosh apples appear to be high considering the fact that losses can be held to negligible amounts if sound stock is carefully handled, but perhaps they are really not so high if profit per unit of display space is considered, since apples are not a fast moving item in most stores. Many grocers consider a 25-33⅓ per cent gross margin necessary on perishables. But when an average margin above 33⅓ per cent (50 per cent mark-up) is taken on apples, one may well ask whether there is not something seriously wrong with our efficiency in selling apples. The average gross store margin based on some 200 records was approximately 38 per cent of the selling price. (Fig. 11 and Appendix Table XI.) This seems to be in line with data gathered in other studies. Chain stores bought and sold apples for less than independent fruit and grocery stores, but gross margins were almost as large as for independent stores.

Margins vary some in different cities; in several cities an appreciable percentage of the stores were doubling the purchase price. The following table also gives these data:

Table 9. Average Margins on McIntosh Apples in Seven New Hampshire Cities November 15 to December 31, 1940

Type of store	Number of records taken	Average gross margin (Per cent of the selling price)	Margins most frequently taken (Per cent)	Cases in which the selling price was at least double the purchase price (Per cent)
Chain stores	30	36	43	10
Fruit stores	24	47	45	33
Independent stores	90	36	33 & 43	12
All*	144	39*	43*	17*
Cities				
Claremont	12	36	29	8
Concord	20	42	45	25
Keene	10	40	48	20
Laconia	12	32	36	0
Manchester	53	43	43	23
Nashua	29	34	43	10
Rochester	8	34	29	0
All*	144	39*	43*	17*

*Weighted averages.

RETAIL DISPLAYS

In 73 retail stores which displayed apples, citrus fruits, or both in front windows in the November-March period, approximately twice the display space was given to citrus fruits as to apples. (See Appendix Table XII.)

About half the retail stores included in this study sold McIntosh apples from the original box, and about one-sixth sold from display bins or piles. The balance sold in both ways (Table 10).

Table 10. Apple Sales from Original Boxes and from Stands

	No. records	Per cent of stores
Sales made from original box	119	50.6
Sales made other than from original box	37	15.8
Sales made in both ways	79	33.6
	235	100.0

Samples were collected from lots sold in original boxes and those displayed in other ways. Table 11 shows that fruit sold from the original box was in much better condition than fruit which had been rehandled for display; it was less bruised and showed on the average only 58 per cent as much waste.

Table 11. Condition of Apples Displayed in Original Boxes, on Stands, and in Bins

	Number samples	Punctures per 100 fruits	Small bruises per 100 fruits	Large bruises per 100 fruits	Per cent surface bruises	Per cent waste
In original box	52	81	495	119	8	6.4
Outside original box	63	81	545	178	11.2	11.1

Consideration should be given to the adoption of boxes more suitable for display in retail stores—such boxes to be returnable to the grower servicing the store. Two types of paper containers which appear satisfactory for store delivery are shown in Fig. 12. One separates each apple, and the other is used with a wrapped pack.

A very small per cent of New Hampshire McIntosh apples reaches consumers in package form. In general, consumer packages have been rather expensive for use on a commodity such as apples. Furthermore, many of the packages developed have not displayed the

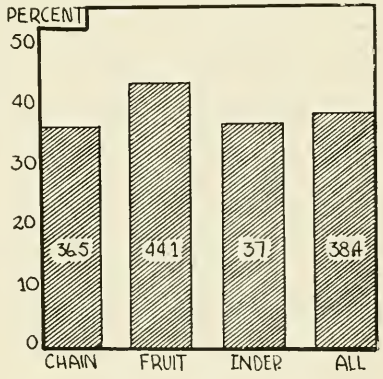

Fig. 11. Average Gross Margin (per cent of selling price) on McIntosh Apples Sold in Different Types of Stores, 1940-1941

Fig. 12. Boxes Suitable for Sale to Retail Stores or Direct to Customers

Top: Large apples carry well in boxes with individual sections. This is a good consumer or gift size. Larger sizes are more frequently used for retail store trade. Bottom: This box carries wrapped packs satisfactorily for fancy store trade.

FIG. 13. CONSUMER PACKAGES

TOP: A SUITABLE CONSUMER GIFT PACKAGE FOR SHIPMENT BY PARCEL POST OR EXPRESS. BOTTOM: A CONSUMER PACKAGE FOR USE IN RETAIL STORES: EASILY SET UP, LOW IN PRICE, TAKES APPLES WITH SOME VARIATION IN SIZE AND DISPLAYS THE PRODUCT FAIRLY WELL.

apples in such fashion as to give maximum consumer appeal, or to justify the additional expense. Any package adopted should also serve to reduce bruising and handling expense in retail stores. In fact, one of the principal purposes of a package for McIntosh apples should be that of carrying the fruit to consumers in better condition.

Two good types of package are now available: one for mail order shipping, and the other for retail stores. Under war conditions, prices and supplies may restrict use, but future development may occur after the war. Figure 13 shows several of these packages.

PACKAGING AND HANDLING

The question arises as to what practices contribute to the changes in condition of the fruit from the time it leaves the grower's hands to the time it comes into the hands of the consumer. Some have thought the tightness of the pack might be a factor in injury to apples. Packs of the three types were made up and placed in storage at the University cold storage plant as soon as the fruit was harvested. Some of them were removed December 20 and others February 6, at which time the packages were hauled and handled uniformly before examination. One could hardly say that there was an appreciable difference between the three packs so far as they result in punctures and small or large bruises. (See Table 12.)

To determine the effect of rough handling of the boxes, various forms of violence were practiced on the packages. Figure 14 shows the results of such experiments. In examining these data it is well to keep in mind that the numbers recorded are not the actual number of punctures, small bruises, and large bruises, but the number *in addition* to those found on fruit which had not undergone this treatment. In these tests we endeavored to approximate the results of certain practices which might be used by stores or trucking firms in the handling of boxed apples. Pouring and filling, for instance, approximates what the grocer does when he takes a box of apples and pours them upon a table or in the store window, then afterwards puts them back in the box. Dropping a box 15 inches is a very close approximation to what truck drivers may do to apples in the box when moving them from one

Table 12. Effect of Tightness of Pack on Defects

	Weight of apples in box*	Number of apples in box	Per 100 fruits			Perfect apples per box
			Stem punctures	Small bruises	Large bruises	
	Data Taken - December 20, 1940					
Flat pack	39.9	126	36	215	121	7
Medium bulge	41.8	135	38	211	128	8
Heavy bulge	44.2	148	35	204	122	6
	Data Taken - February 6, 1941					
Flat pack	37.9	128	25	226	66	9
Medium bulge	40.7	144	27	242	90	5
Heavy bulge	42.3	140	36	247	125	4

* Boxes 1⅛ bu. - 16 inch x 13⅝ inch x 11⅛ inch - note shrinkage in 38-day period.

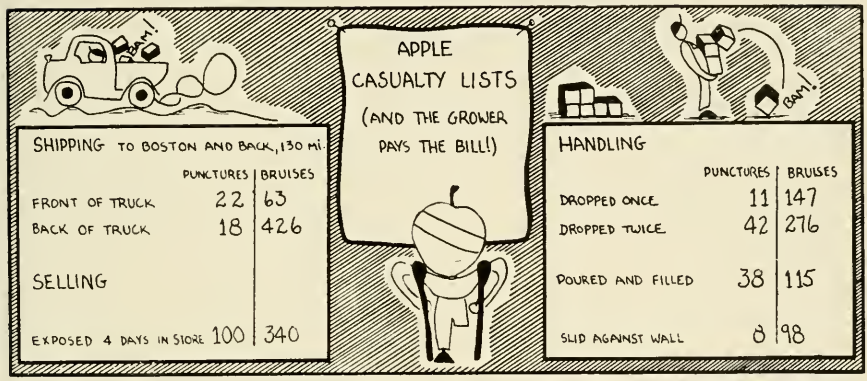

Fig. 14. Additional Defects per 100 Fruits Resulting from Handling

truck to the other, or from a truck into the store. Sliding against the wall was intended to approximate what happens when one slides a box of apples into a truck. The apples hauled to Boston and back underwent exactly what happens to much of the fruit sold from New Hampshire to wholesalers and brought back again in small quantities. In this experiment the fruit went down on our regular delivery truck to the wholesale house in Boston and was brought back on the same truck to our own storage, where counts were made. Some of the fruit was hauled down and back at the front end of the truck, and some at the back end. On the return trip, of course, the truck was nearly empty and the roughness of the road was felt much more. Samples were taken to a local store in Durham, and sold directly from the box during the following four days.

An examination of the data indicates that pouring and refilling a box greatly increases the number of punctures and small bruises. On the other hand, dropping a box of apples produces a number of large bruises. Defects of this kind greatly increase the amount of waste. Usually one bruise will increase the amount of waste in an apple by at least 5 per cent. When the boxes were dropped twice, the amount of damage of all kinds was practically doubled. The damage done by sliding a box against the wall is much less than that caused by dropping. Hauling fruit to Boston and return on the front part of the truck did not produce a great amount of damage, but hauling it on the back of the truck with a light load increased the amount of large bruises so that 20 per cent or more of the fruit was wasted. Exposing fruit for sale in the original package greatly increased the number of stem punctures and small bruises. There was no marked increase in large bruises. It is evident that it is possible to produce a very large amount of damage to fruit by rough handling before it gets into the hands of the grocer. Likewise, rough handling of the boxes in the store, while moving them around from one place to another, will produce similar bruises and stem punctures, and if the fruit is sold outside of the original container it is likely that many stem punctures and small bruises and some large bruises will be added.

To determine whether the size of the fruit had any effect on the amount of damage, three boxes were filled: one with large apples, another with small, and a third with half large and half small. The packed boxes were then dropped twice, a distance of 8 inches, and the effect determined. Table 13 shows the results.

It is evident that large apples are more easily damaged than small ones, and it also appears that when large apples are mixed with small ones in the boxes the large apples are damaged more than when packed alone.

Table 13. Mechanical Damage to Apples of Different Sizes When Boxes are Dropped Twice from Eight Inch Heights

Size apples	Number in box	Per 100 fruits		
		Large bruises	Punctures	Not injured
Large	122	116	44	19
Small	188	84	26	35
Mixed box:				
Large	67	124	60	16
Small	94	87	35	38
Total	161	211	95	54

PICKING INJURIES TO McINTOSH

Even in the growers' hands apples sustain many injuries; consequently every grower should determine just what is happening during the picking process. Table 14 tabulates the results of a small test on picking methods. These are the average of two years' results, using eight boxes in each treatment. While not elaborate enough for positive conclusions, they give a general picture of the extent of fruit injuries sustained in the orchard. However, it seems that damage elsewhere is much more important regardless of the type of container used in picking.

Table 14. Effect of Picking Methods on Mechanical Injuries to McIntosh

Type of picking container	How transferred to orchard box	Large bruises per 100 fruits	Small bruises per 100 fruits	Punctures per 100 fruits	Per cent perfect fruit
Canvas bag with open bottom	Bag carefully opened at bottom	9	83	4	49
Solid side bag with canvas bottom	Bag carefully opened at bottom	4	116	5	35
Pail or basket	Poured carefully	10	141	5	27
Pail or basket	Transferred by hand	6	128	4	50
Average of all methods		7	117	4.5	40

Table 15 is included to show the relative condition of freshly picked apples in orchard boxes at the packing table as compared with (1) packed boxes in the grower's hands and (2) the product the consumer receives. In this connection, it must be remembered that punctured and badly bruised fruit is discarded before packing, whereas damage in the orchard boxes may have been done on the tree. (See also Appendix Table XIII.)

Table 15. Condition of McIntosh Apples in Orchard Boxes, in Packed Boxes at Growers, and as Sold in Retail Stores

	Per 100 fruits			
	Cuts and punctures	Bruises over ½ inch	Small bruises	No injury
In orchard boxes	4.5	7	117	40
Packed boxes at grower's place	32	34	240	8
From selected growers as sold in stores	81	126	405	0

SUMMARY

Varieties. McIntosh apples were handled by over 86 per cent of the stores selling apples before January 1 and by 77 per cent in February.

Sources. Of stores contacted in the 1940-41 season, 40 per cent of the chains and 78 per cent of the independent groceries and markets obtained apples from within New Hampshire. Early in the season chains bought 60 per cent and independent groceries and markets bought 82 per cent of their McIntosh from within the state. Late in the season chains bought 19 per cent and independent groceries and markets 78 per cent of their McIntosh apples in the state.

Condition of McIntosh. Producers vary considerably in their ability to place good-quality McIntosh apples in city markets. The bruised surfaces on McIntosh apples bought in eight cities ranged from an average of 6.3 per cent to 13.3 per cent of the total surface area. The average waste varied from 4.3 per cent to 17.2 per cent in different cities. Those hauled to stores over short distances were in no better condition on the average than those hauled over longer distances, presumably because the poorer apples were delivered into near-by markets.

McIntosh delivered from cold storages showed 22 per cent less waste on the average than those delivered from common storages. McIntosh from growers' storages showed 33 per cent as much waste, 27 per cent as many large bruises, and 39 per cent as much bruised surface as did the same grower's apples bought from retail stores.

The method of handling has far more to do with the condition of McIntosh than the length of time they are held in the store. Apples sold from the original box were in much better condition than those sold from the counter. They had 42 per cent less waste and 50 per cent fewer large bruises. Samples purchased from fruit stores had the most waste (10.9 per cent), and those from independent groceries

and markets, the least (7.4 per cent). Those from chain stores showed the largest number of bruises (averaging 176 per 100 fruits), and those from independent groceries and markets, the fewest (averaging 118 per 100 fruits).

Sales. Weekly sales of McIntosh apples in different types of stores in December, 1940, ranged from an average of 2.1 boxes in small grocery stores to 21.2 boxes per week in self-service chain stores. Over half the weekly sales of McIntosh by super-markets were made on Friday and Saturday, according to test sales. The rate of sale for McIntosh in retail test sales was over twice as great in the afternoon as in the morning.

Large size (3 inch) Fancy McIntosh sold best in test sales in chain markets and returned the highest profits. Faced McIntosh (red side out) sold over three times faster at retail, and for more money, than unfaced ones of the same grade in an adjoining display. Gross profits on faced apples were about four times as great. Appearances certainly do count in customer appeal and in profits from sales.

Bruising reacts on sales. Unbruised apples in test sales sold over three times as fast and were far more profitable than conspicuously bruised ones of the same grade. In about half the stores in which inquiries were made, McIntosh apples were sold from the original box. These were in better condition than those which had been rehandled.

Prices. Small price increases did not reduce sales in several test sales where apples were the very best and prices did not exceed 8 cents a pound. Quality and condition were more important factors than price in the sale of the best grades of apples.

Margins. Average gross retail profits observed in seven cities varied from 32 to 43 per cent. Average gross profits in 207 stores varied from about 37 per cent in chain and independent stores to 47 per cent in fruit stores.

Displays. Of 211 stores contacted, 47 per cent had apples on display in front windows, and 29 per cent had McIntosh apples.

Packages. Retail packages for apples have not been very successful to date because of cost or because they have not properly displayed the fruit. But some new developments look promising for use in the sale of high grade fruit. A tray or display package to be set in place in stores by the grower or packer could answer the bruising problem at least partially.

Handling. Dropping a box of apples greatly increases the number of large bruises. Hauling apples on the back of a lightly loaded truck causes greater increase in bruises than does hauling in a loaded truck or on the front part of vehicle.

APPENDIX

TABLE I. PERCENTAGE OF STORES HANDLING DIFFERENT APPLE VARIETIES

	Chain stores	Fruit stores	Ind. groc. & mkts.	All stores
Nov. 15 - Dec. 31, 1940				
McIntosh	97	79	84	86
Baldwins	74	62	91	81
Delicious	32	65	12	28
Cortland	24	3	6	9
Northern Spy	0	3	9	6
Other varieties	3	9	12	10
Total stores contacted	34	34	88	156
Feb. 1941				
McIntosh	87	56	76	77
Baldwin	67	61	74	68
Winesap	52	52	5	34
Cortland	35	4	2	16
Delicious	37	56	19	34
Northern Spy	2	4	12	6
Other	9	4	5	6
No. stores contacted	46	23	42	111

TABLE II. SOURCE OF MCINTOSH APPLES FOR RETAIL STORES IN VARIOUS SECTIONS OF NEW HAMPSHIRE, SEASON 1940-41

Section of state	No. of contacts	Percentage obtaining apples from		
		Same county	Another county	Another state
		Chain stores		
3 northern counties	21	0	0	100
4 central counties	49	30.6	12.2	57.2
3 southern counties	37	43.3	16.2	40.5
All counties	107	29.0	11.2	59.8
		Independent retailers		
3 northern counties	16	12.5	6.2	81.3
4 central counties	88	72.7	9.1	18.2
3 southern counties	95	51.6	30.5	17.9
All counties	199	57.8	19.1	23.1
		All retail stores		
3 northern counties	37	5.4	2.7	91.9
4 central counties	137	57.7	10.2	32.1
3 southern counties	132	49.2	26.5	24.3
All counties	306	47.7	16.3	36.0

TABLE III. CONDITION OF SAMPLES FROM GROWERS COMPARED TO FRUIT SOLD BY STORES

McIntosh apples from	Number of samples	Per 100 fruits		Large bruises	Per cent surface bruised	Per cent waste
		Cuts and punctures	Small bruises			
Grower 1 at storage	2	40	230	40	3.6	5.4
as sold in stores	4	70	430	70	5.0	10.1
Grower 2 at storage	1	30	230	20	3.3	1.2
as sold in stores	3	80	540	130	7.5	5.8
Grower 3 at storage	1	50	290	0	2.2	4.4
as sold in stores	12	100	550	160	9.6	11.1
Grower 4 at storage	2	50	335	60	3.1	2.3
as sold in stores	8	86	540	124	9.5	7.7
Grower 5 at storage	1	10	130	30	1.2	.5
as sold in stores	3	80	533	127	7.5	5.8
Grower 6 at storage	2	30	180	50	5.0	3.2
as sold in stores	2	20	165	185	5.3	2.7
Grower 7 at storage	1	40	120	0	2.5	.1
as sold in stores	6	32	295	127	7.7	3.4
Grower 8 at storage	1	10	210	70	4.0	1.0
as sold in stores	2	70	350	55	2.1	3.2
Grower 9 at storage	1	10	310	30	1.6	.2
as sold in stores	3	37	583	147	6.0	1.8
Grower 10 at storage	1	20	340	40	.6	.3
as sold in stores	2	35	270	15	2.7	1.1
Market agency as sold in stores	12	90	520	180	8.0	9.2
Boston warehouse as sold in stores	7	114	783	293	20.0	9.7

TABLE IV. CONDITION OF APPLES COLLECTED IN VARIOUS MONTHS FROM GROWERS' STORAGES AND FROM RETAIL STORES

Month	Number of samples		Cuts per 100 fruits		Small bruises per 100 fruits	
	Grower	Store	Grower	Store	Grower	Store
Nov.	3	33	66	77	353	589
Dec.	5	66	50	88	482	527
Jan.	1	10	50	63	190	283
Feb.	4	33	25	55	370	376
March	1	49	40	46	120	271

Month	Large bruises per 100 fruits		Per cent bruised surface		Per cent waste	
	Grower	Store	Grower	Store	Grower	Store
Nov.	110	177	6.2	9.7	9.9	12.2
Dec.	126	145	7.9	10.6	6.2	9.6
Jan.	30	97	2.8	8.8	1.7	6.6
Feb.	56	142	2.3	4.7	1.2	2.9
March	0	102	2.5	8.1	.1	3.

TABLE V. SALES OF McINTOSH ON EACH WEEK DAY
(FIGURES ARE PERCENTAGES OF TOTAL WEEKLY SALES)

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Total
Store 1	9.5	5.6	19.4	9.9	19.4	36.2	100
Store 2	9.8	10.5	9.6	12.9	21.5	35.7	100
Both stores	9.7	8.2	14.3	11.5	20.4	35.9	100 (½)

TABLE VI. NUMBER OF DAYS McINTOSH APPLES WERE HELD IN STORES
(FIGURES ARE PERCENTAGES OF STORES IN EACH GROUP)

Period apples had been in store at time of visit	Chain stores	Fruit stores	Ind. grocer. & markets	All stores
3 days or less	63.6	57.7	61.5	61.7
4 - 7 days	24.2	34.7	28.2	27.8
8 - 14 days	4.6	3.8	6.8	5.7
Over 14 days	7.6	3.8	3.5	4.8

TABLE VII. EFFECT OF DAYS IN STORE ON CONDITION OF APPLES

Days in store	Punctures per 100 fruits	Small bruises per 100 fruits	Large bruises per 100 fruits	Per cent surface bruised	Per cent waste
		Super-market			
New	110	940	250	16.9	9.2
1	150	1050	250	18.8	11.4
2	140	1220	330	27.5	14.0
3	220	1110	170	15.0	17.0
4	140	770	310	19.8	13.5
5	180	1050	540	25.3	16.5
		Fruit Store			
New	80	650	100	8.6	5.0
1	90	740	80	10.6	7.3
2	50	630	50	5.7	3.6
3	80	560	40	8.0	4.2
4	140	800	120	10.4	7.8
5	80	880	90	10.8	4.8
6	90	850	120	11.5	5.0
7	110	1040	30	9.9	5.8

TABLE VIII. DESCRIPTION OF APPLES HANDLED IN EXPERIMENTAL RETAIL SALES

Grade	Size	Approx. no. per box	Av. no. bruises per apple (large)	Av. no. bruises per apple (small)
		(Nashua store)		
Fancy (Bruised lot)	3 in. min.	109	2.6	3.8
Fancy (Least bruised)	3 in. min.	109	1.1	2.2
Mass. Fancy	3 in. min.	105	2.9	2.3
N. H. Fancy	2½ in. min.	158	1.1	2.6
U. S. No. 1	2½ in. min.	174	1.4	1.2
Cortland U. S. No. 1	2½ in. min.	134	1.4	1.9
Macs (4-lb. retail boxes)		224	.7	2.1

	Av. no. stem punctures per apple	Per cent bruised surface	Per cent waste	Per cent color
Fancy (Bruised lot)	1.5	12.9	8.8	51
Fancy (Least bruised)	.7	3.3	4.5	64
Mass. Fancy	.7	11.5	10.5	61
N. H. Fancy	.9	6.2	4.7	60
U. S. No. 1	.4	6.3	5.6	51
Cortland U. S. No. 1	.6	4.3	5.6	66
Macs (4-lb. retail boxes)	.3	4.9	6.3	49

TABLE IX. COMPARATIVE PRICES, SALES, AND MARGINS ON APPLES HANDLED IN TEST SALES IN THE DOVER STORE

Description	Average selling price (cents per pound)	Per cent of average gross profit	Per cent of sales Mon. - Thurs. (per display)	Average gross daily profit Mon. - Thurs. (per display)
A Fancy Macs. - 3 in. min.	8.2	34	27	$1.19
B Fancy Macs. - 2½ in. min.	7.3	30	22	.71
C Fancy Macs. - 2¼ in. min.	6.5	46	7	.26
D Macs. - 2¼ in. min. (Best 3 in. out)	6.	42	13	.60
E Macs. - grade B - 2½ in. min.	5.8	38	4	.13
F Macs. - orchard run (culls out)	5.9	35	8	.27
G Macs. - Sizes under 2¼ in.	3.4	32	6	.13
H Cooking apples - (no grade)	4.2	18	9	.14
I W. Delicious (Ex. Fancy)	7.5	28	5	.16

TABLE IX (CONT'D). COMPARATIVE PRICES, SALES, AND MARGINS ON APPLES HANDLED IN TEST SALES IN THE DOVER STORE

Description	Per cent of total sales Friday	Average gross profit Friday (per display)	Per cent of total sales Saturday	Average gross profit Saturday (per display)
A Fancy Macs. - 3 in. min.	-	-	-	-
B Fancy Macs. - 2½ in. min.	19	$1.20	26	$2.82
C Fancy Macs. - 2¼ in. min.	8	.47	21	2.70
D Macs. - 2¼ in. min. (Best 3 in. out)	11	.67	32	3.31
E Macs. - grade B - 2½ in. min.	7	.42	6	.64
F Macs. - orchard run (culls out)	11	.60	-	-
G Macs. - Sizes under 2¼ in.	24	.67	-	-
H Cooking apples - (no grade)	14	.13	5	.02
I W. Delicious (Ex. Fancy)	7	.54	10	.86

TABLE X. COMPARATIVE RETURNS PER BOX FROM THREE SIZES OF FANCY McINTOSH

Grade & size	Pounds sold	Cost per box	Retail price per box	Profit per box	Gross profit per cent	Total gross profit
3 in. Fancy	167	$2.25	$3.45	$1.20	35	$5.12
2½ in. Fancy	130	2.10	3.05	.95	31	2.95
2¼ in. Fancy	32	1.50	2.48	.98	40	.75

TABLE XI. PRICES PAID, RECEIVED, AND GROSS MARGINS IN RETAIL STORES, 1940-1941

	Type of store (1940-41 season)			All stores
	Chains	Fruit stores	Groc. and markets	
No. records included	33	36	138	207
Average price paid per box	$1.34	$1.56	$1.45	$1.45
Average price rec'd per box	$2.11	$2.79	$2.30	$2.35
Gross margin	$0.77	$1.23	$0.85	$0.90
(Per cent selling price)	36.5	44.1	37	38.4

Table XII. Apples and Citrous Fruits Displayed in Front Windows of New Hampshire Retail Stores

Season 1940-41

(Based on observations in 211 stores)

	No. stores	Per cent of stores
Apples in front windows	99	47
McIntosh in front windows	61	29
Other varieties in front windows	69	33
Citrous fruits in front windows	146	69
Number of stores contacted	211	100

Table XIII. Condition of Apples as Sold in Certain New Hampshire Stores, 1940-41

	Number samples	Per 100 fruits			Per cent surface bruised	Per cent waste
		Cuts and punctures	Small bruises	Large bruises		
Chain A	13	77	519	158	8.7	8.9
Chain B	22	108	686	203	9.3	14.0
Independent 1	5	130	640	290	10.5	12.2
Independent 2	4	50	440	160	9.6	7.8
Independent 3	2	50	440	120	9.0	10.5
Independent 4	3	40	420	180	8.2	33.7
Other stores	36	140	490	150	7.7	8.4